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Semi-tensor product compressive sensing and its application in image processing

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Compressive sensing (CS) is a popular research at home and abroad. One of the key bases of modern signal processing is the Shannon-Nyquist sampling theory, where the number of discrete samples required for a signal that can be reconstructed without distortion is determined by its bandwidth. As a new sampling theory, CS can obtain discrete samples of the signal by random sampling, which is far less than the Shannon-Nyquist sampling rate by the sparse characteristic of the signal, and then CS can reconstruct the original signal by non-linear reconstruction algorithms. CS was proposed by Terence Tao (the winner of Fields Medal), Emmanuel Candès (IEEE Fellow), and David Donoho (the member of the US National Academy of Sciences) in 2004. This theory has received wild attention in academia and industry once it has been put forward. It has been applied into the fields of signal processing, digital communication, network security, image processing, medical imaging, geologic survey, radiating systems etc. It has been rated as the top 10 scientific and technological progress in 2007 by American Science and Technology Review. This speech focuses on the latest research progress of semi-tensor compressive sensing theory and its application in image processing. This speech introduces the basic theory of CS from the point of view of collecting data more effectively, and introduces our newly proposed semi-tensor compressive sensing theory, which breaks through the limitation of traditional compression perception matrix. The dimension of the measurement matrix that needs to be processed during the sampling recovery process is greatly reduced so that the signal is processed and restored at a lower sampling rate than the classical CS theory.

Recent Publications

1. Peng H, Tian Y, Kurths J *et al.* (2017) Secure and energy-efficient data transmission system based on chaotic compressive sensing in body to body networks. IEEE Transactions on Biomedical Circuits and Systems 11(3):558-573.

2. Xie D, Peng H, Li L *et al.* (2016) Semi-tensor compressed sensing. Digital Signal Processing 58:85-92.

3. Xie D, Peng H, Li L *et al.* (2017) An efficient privacy-preserving scheme for secure network coding based on compressed sensing. International Journal of Electronics and Communications (AEÜ) 79:33-42.

4. Gao B, Li L, Peng H, *et al.* (2013) Principle for performing attractor transits with single control in Boolean networks. Physical Review E 88(6):062706.

5. Li L, Xu D, Peng H *et al.* (2017) Reconstruction of complex network based on the noise via QR decomposition and compressed sensing. Scientific Reports 7:15036.

Biography

Haipeng Peng received the MS degree in System Engineering from Shenyang University of Technology, Shenyang, China, in 2006, and the PhD degree in Signal and Information Processing from Beijing University of Posts and Telecommunications, Beijing, China, in 2010. He is currently a Professor at the School of Cyber Space Security, Beijing University of Posts and Telecommunications, China. His research interests include information security, network security, complex networks and control of dynamical systems. He is the co-author of over 100 scientific papers. His SCI citations of other scholars are over 1400 times, and his Google citations are over 2700 times.

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